Fourth Annual Conference on Carbon Capture & Sequestration

Developing Potential Paths Forward Based on the Knowledge, Science and Experience to Date

Sequestration Policy and Feasibility Studies (1)

CO2 for Enhanced Oil Recovery Needs Enhanced Incentives

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May 2-5, 2005, Hilton Alexandria Mark Center, Alexandria Virginia

The CO2 Value Chain

CO_2 SOURCES

NH3, H2 og gasification plants

Natural gas processing

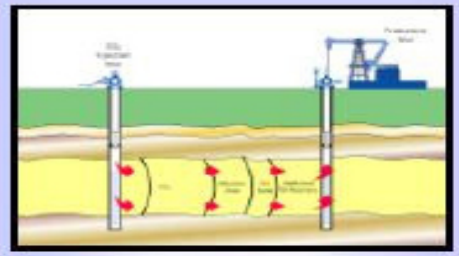
Powerplants

CO_2 LOGISTICS

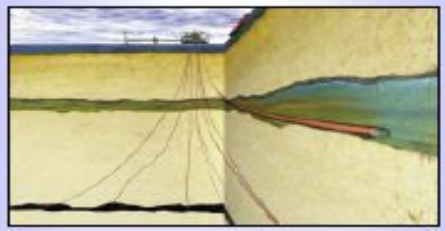
Ships

Pipelines

CO_2 MARKET



Increased oil recovery



Storage in geological formations

Image by courtesy of Statoil

STATOIL

Why is the CO2 Value Chain Important?

- Shifts focus of GHG emissions from a regulatory problem towards commercial solutions.
- Enables markets to evolve under stable policies in a “defined playing field”.
- Provides mechanism for resource development and wealth creation.
- Provides policy alternatives to address issues of industrial development, energy security and climate-change.

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The Value of Incentives

- Markets will evolve and projects can develop along the CO2 value chain.
- But additional incentives to promote CO2 for EOR could kick start this market.

- CO2 Sequestration has been shown to provide the greatest impact on CO2 emission reductions and CO2-EOR is a commercial subset for early implementation.

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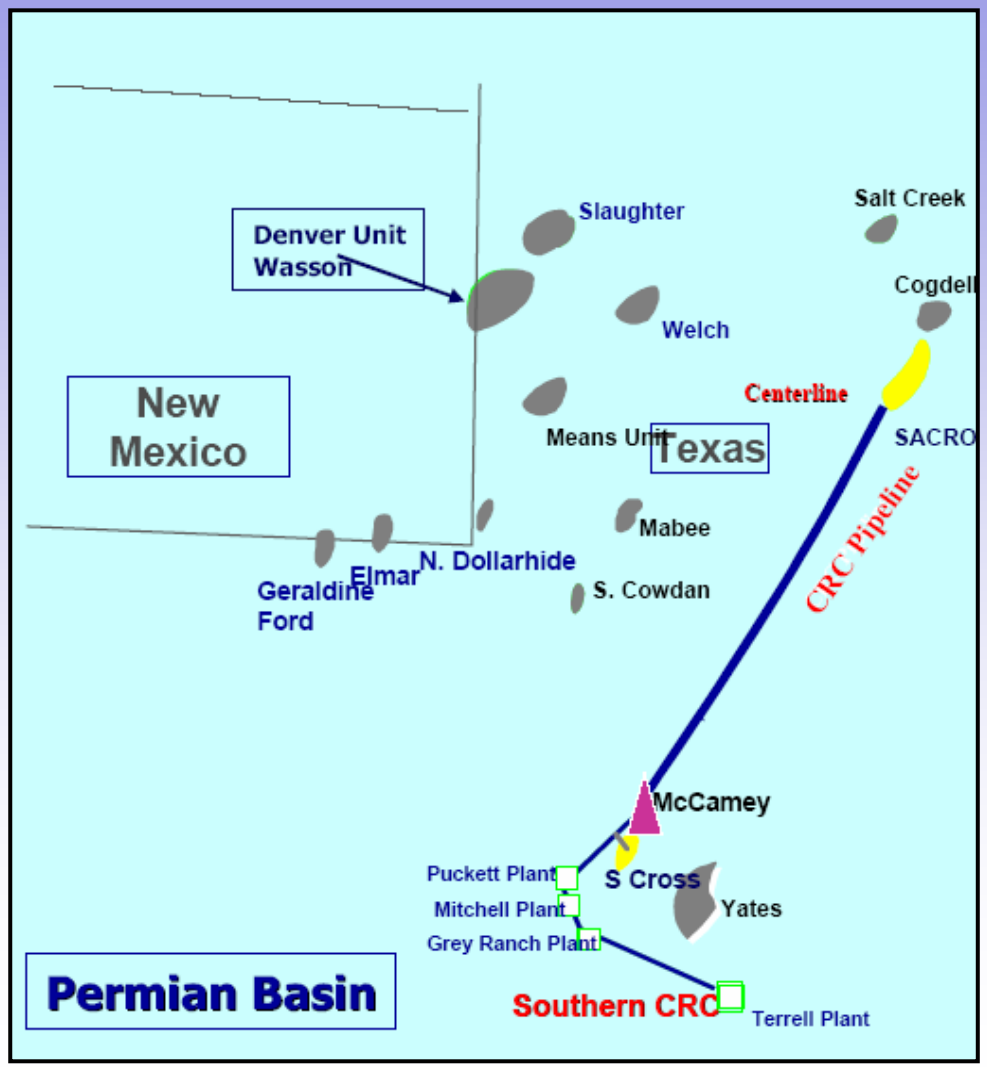
Permian Basin 1970 - 1973



Map by courtesy of David L. Coleman

- "Allowables" or production caps removed for EOR projects.
- Chevron / Shell collaborated and used Anthropogenic CO2 (A-CO2) for EOR.
- Chevron built 175 mile CRC pipeline to SACROC.
- SACROC is first large CO2-EOR flood.
- Production dramatically increased.

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Permian Basin 1979 - 1989

Map by courtesy of David L. Coleman

- Naturally occurring CO2 discovered.
- Shell, Mobile, Amoco & ARCO build infrastructure.
- Tertiary Incentives enacted
  - Free market price (’79)
  - WPT reduction (’81)
  - 15% Inv. Tax Credit (’82)
  - Texas Severance Tax reduced by 50% (’82)

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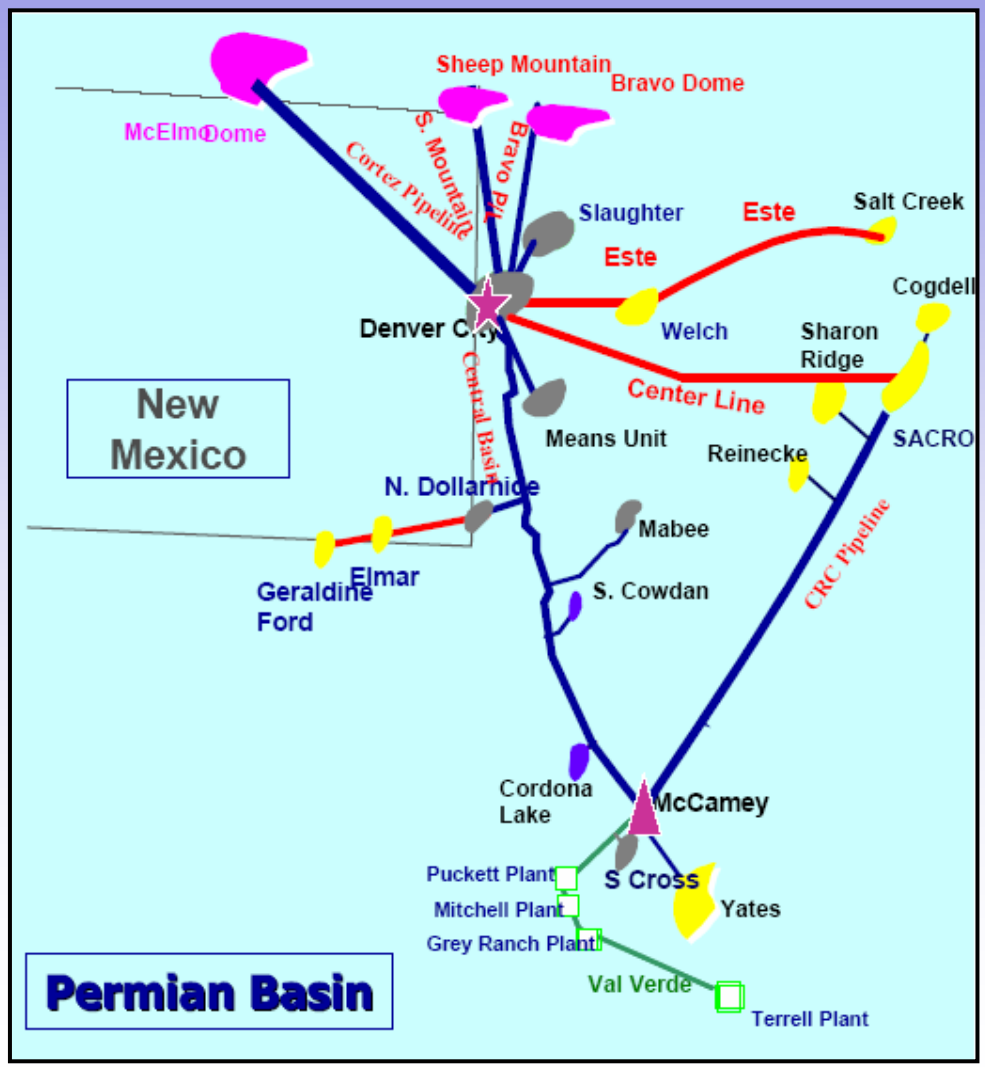
Permian Basin 1990 - 2005



Map by courtesy of David L. Coleman

- Incentives renewed.
- Inv. Tax Credit proposed to be raised to 25%.
- Continued Expansion.
- New Pipelines.
- New Players – Majors leaving:
  - Oxy Permian
  - Kinder Morgan
  - Apache / XTO

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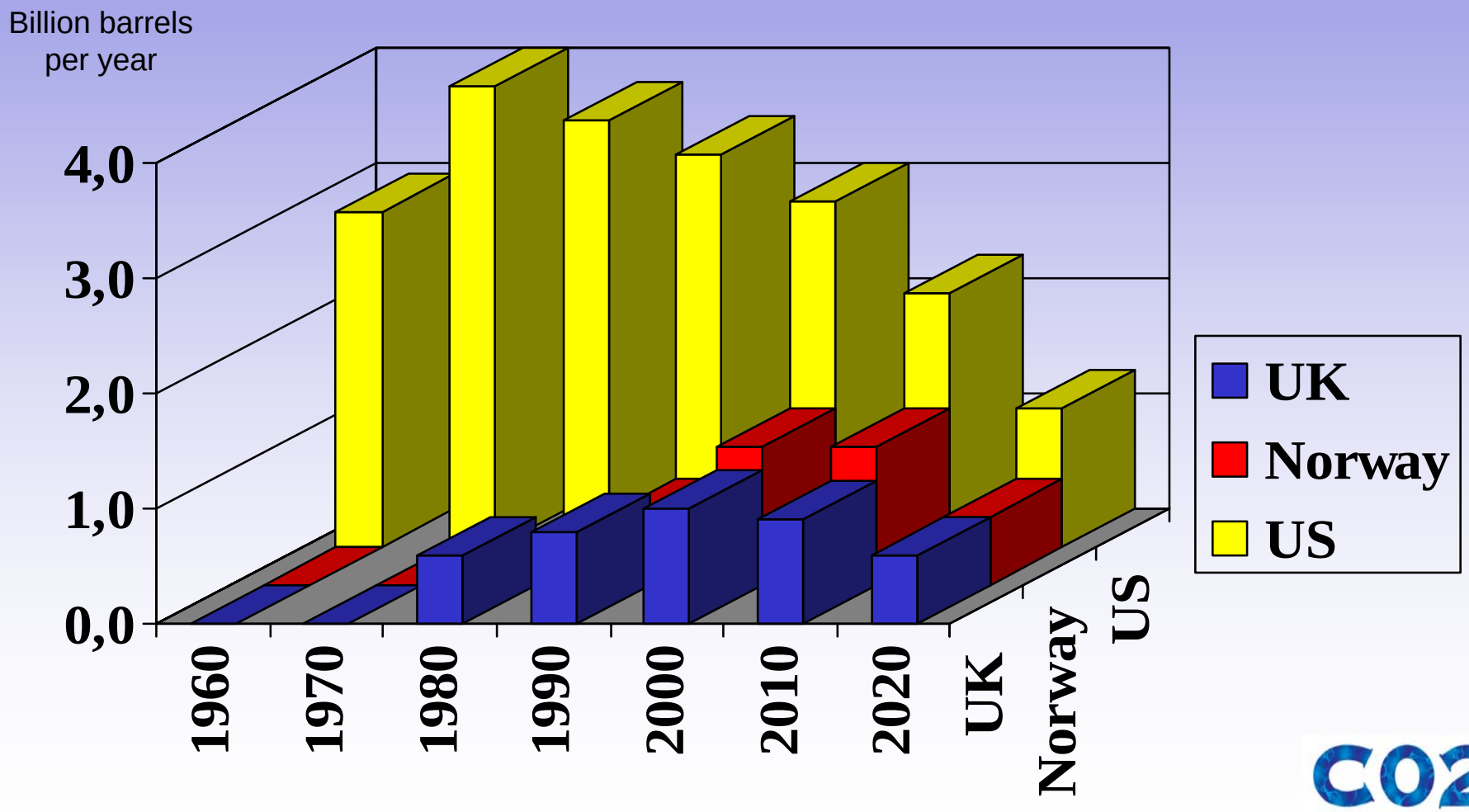
Comparison between US & North Sea Oil Production (1960 - 2020)



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Drivers in Support of Incentives for EOR in the North Sea

- Declining oil production from North Sea Continental Shelf.
- Delay costly decommissioning of platforms.
- Increasing dependence upon energy imports in UK and EU.
- Commitments to reduce CO2 emissions under Kyoto and beyond.

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What should an efficiently designed Incentive do?

- Encourage investment in CO2-EOR activity.
- Encourage oil production.
- Encourage infrastructure construction.
- Encourage incremental tax revenue generation to pay for the incentive.
- Reduce exposure of the operator to market price risks.

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What types of Incentives are there?

- **Investment tax credits** (15-25% of investment).
- Accelerated depreciation of investments (1yr).
- Additional deductions to revenue (Volume Allowance).
- Reduced Royalties.
- **Reduced tax rates.**
- CO2 Credits.
- **Post-tax Volume Credit.**

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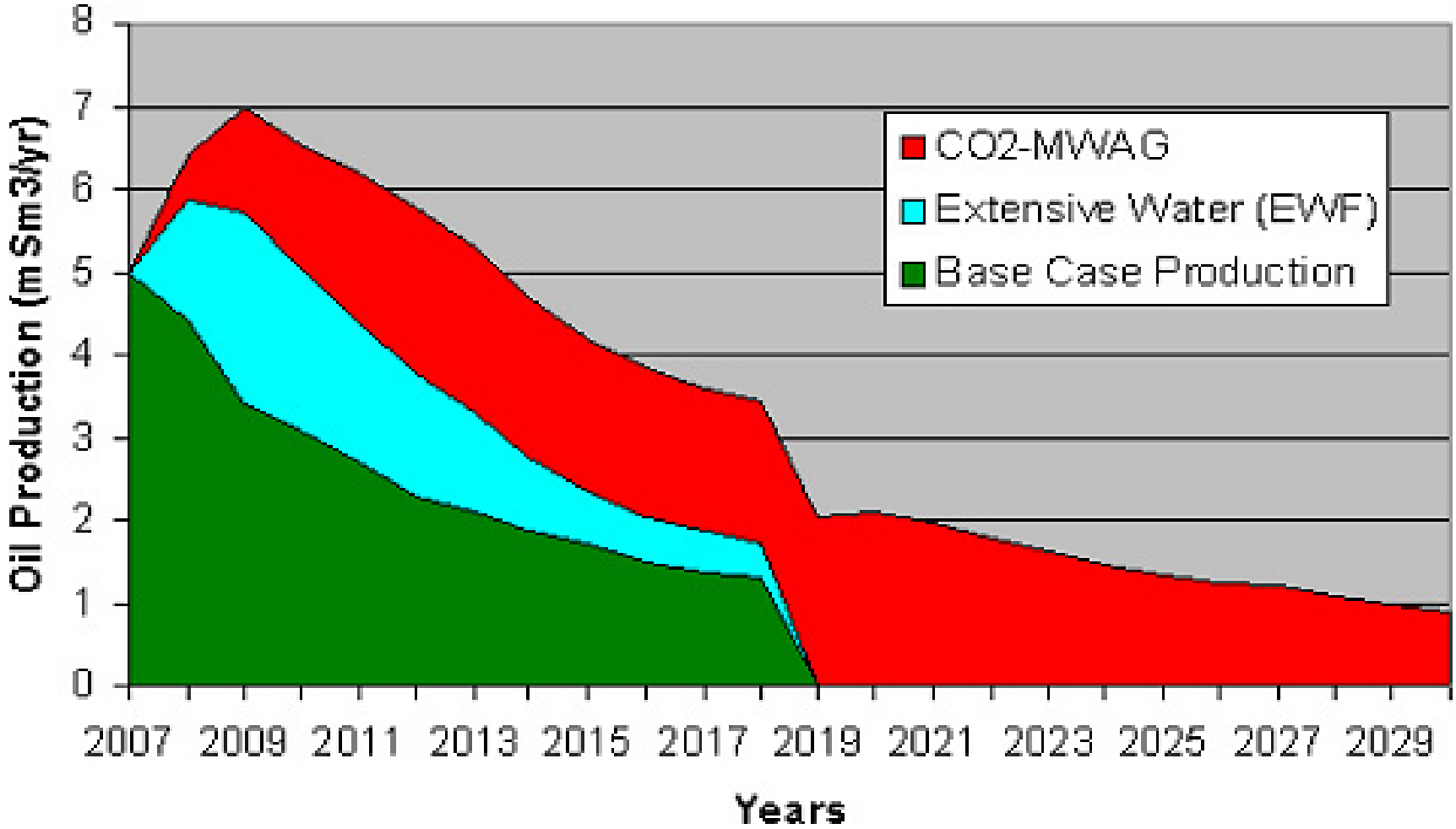
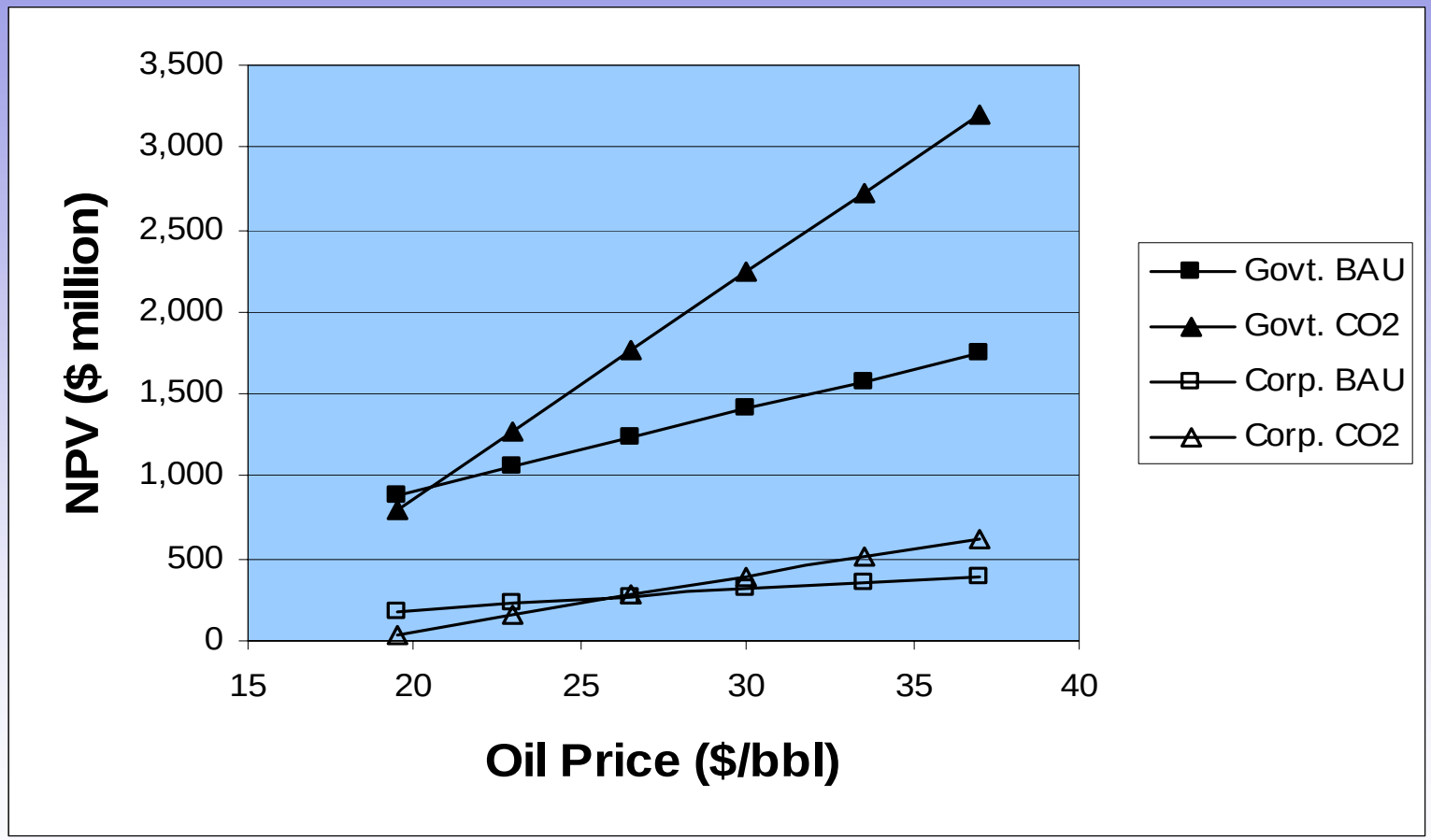
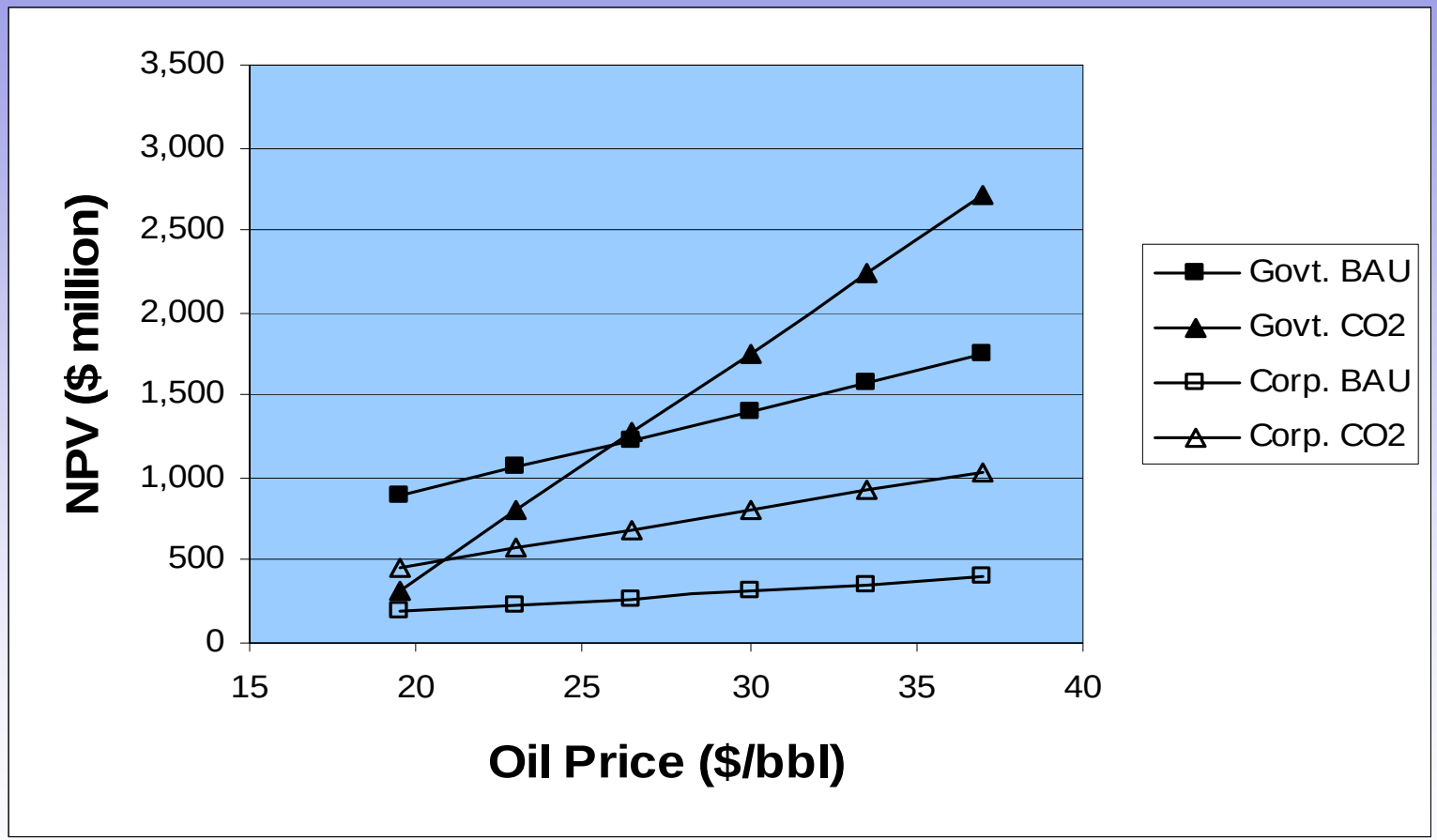
Comparison of Reservoir Production Profiles



Project NPV without Incentives



Project NPV w/ CO2-EOR Vol. Credit



Key Issues to Oil Field Operators

- Perception of future market oil prices.
- Incentives to investment.
- Cost of delivered CO2.
- Security of CO2 supply.

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Key Issues to CO2 Suppliers

- Cost for capturing and gathering the CO2.
- Future regulations for constraining CO2 emissions.
- Cost of alternative options for CO2 avoidance.
- Secure contracting strategies for CO2 supplied and transported.

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Key Facilitating Parameters

- Market oil price.
- CO2 delivered price.
- Government incentives.

Key Players

- Industrial sectors of Oil & Gas, Power, Process, Chemical and Refining.
- The 3 Governmental bodies – Finance, Energy and Environment.

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Conclusions (1)

- Proven technologies exist to capture CO2.
- CO2-EOR is well understood in the oil industry.
- CO2-EOR requires more investment, the purchase of CO2 and greater operating costs than conventional secondary oil production.
- Incentives are required to attract investments.
- History shows where government incentives encouraged EOR, then CO2-EOR projects were developed.

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Conclusions (2)

- There are significant realizable values for treasuries and operators in implementing incentives for CO2-EOR.
- CO2 capture costs will improve with experience.
- CO2 credit trading systems will mature.
- If incentives are strong enough there is no need to wait. Improvements will become upsides to the operators and treasuries.

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Conclusions (3)

- Governments have the incentives to accelerate implementation of large scale CO2-EOR now.
- Attaining meaningful and accelerated reductions in CO2 emissions.
- While also ensuring security of energy supply.

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